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DEFENSE ACQUISITIONS

Key Considerations for Planning Future Army Combat Systems

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Why GAO Did This Study

The Future Combat System (FCS) program—which comprises 14 integrated weapon systems and an advanced information network—is the centerpiece of the Army's effort to transition to a lighter, more agile, and more capable combat force. The substantial technical challenges, the cost of the program, and the Army's acquisition strategy are among the reasons why the program is recognized as needing special oversight and review.

This testimony is based on GAO's March 12, 2009 report and addresses knowledge gaps that will persist in the FCS program as Congress is asked to make significant funding commitments for development and production over the next several years.

What GAO Recommends

In its March 2009 report, GAO suggested Congress consider not approving full funds for the program until several conditions are met, such as preparation of a complete budget for any program emerging from the milestone review. GAO also recommends the Secretary of Defense, among other things, ensure the program that emerges conforms to current defense acquisition policy, such as technology maturity; any spin out approach is based on fully tested results; and any incremental strategy involves free standing, justifiable increments.

DEFENSE ACQUISITIONS:

Key Considerations for Planning Future Army Combat Systems

What GAO Found

The Army will be challenged to demonstrate the knowledge needed to warrant an unqualified commitment to the FCS program at the 2009 milestone review. While the Army has made progress, knowledge deficiencies remain in key areas. Specifically, all critical technologies are not currently at a minimum acceptable level of maturity. Neither has it been demonstrated that emerging FCS system designs can meet specific requirements or mitigate associated technical risks. Actual demonstrations—versus modeling and simulation results—have been limited, with only small scale warfighting concepts and limited prototypes demonstrated. Network performance is also largely unproven. These deficiencies do not necessarily represent problems that could have been avoided; rather, they reflect the actual maturity of the program. Finally, there is an existing tension between program costs and available funds that will likely worsen, as FCS costs are likely to increase at the same time as competition for funds intensifies between near- and far-term needs in DOD and between DOD and other federal agencies.

DOD could have at least three programmatic directions to consider for shaping investments in future capabilities, each of which presents challenges. First, the current FCS acquisition strategy is unlikely to be executable with remaining resources and calls for significant production commitments before designs are demonstrated. To date, FCS has spent about 60 percent of its development funds, even though the most expensive activities remain to be completed before the production decision. In February 2010, Congress will be asked to consider approving procurement funding for FCS core systems before most prototype deliveries, the critical design review, and key system tests have taken place. Second, the program to spin out early FCS capabilities to current forces operates on an aggressive schedule centered on a 2009 demonstration that will employ some surrogate systems and preliminary designs instead of fully developed items, with little time for evaluation of results. Third, the Army is currently considering an incremental FCS strategy—that is, to develop and field capabilities in stages versus in one step. Such an approach is generally preferable, but would present decision makers with a third major change in FCS strategy to consider anew. While details are yet unavailable, it is important that each increment be justifiable by itself and not dependent on future increments.

Mr. Chairman and Members of the Subcommittee:

I am pleased to be here today to discuss the Department of the Army's Future Combat System (FCS), a networked family of weapons and other integrated systems. FCS is in the forefront of efforts to help the Army transform into a lighter, more agile, and more capable combat force by using a new concept of operations, new technologies, and a new information network, linking whole brigades together in a system of systems. Later this year, FCS faces a congressionally mandated go/no-go decision review to determine the program's future. This review is crucial, as production funding and commitments will build rapidly after that point, limiting the government's ability to alter its course.

My statement today is based on the work we conducted over the last year in response to the National Defense Authorization Act for Fiscal Year 2006, which requires GAO to report annually on the FCS program.¹ This statement discusses the knowledge gaps that will persist in the FCS program as Congress is asked to make significant funding commitments for development and production over the next several years. For additional information on these issues, please refer to our report released March 12, 2009.²

Background

The FCS concept is designed to be part of the Army's Future Force, which is intended to transform the Army into a more rapidly deployable and responsive force that differs substantially from the large division-centric structure of the past. The Army is reorganizing its current forces into modular brigade combat teams, each of which is expected to be highly survivable and the most lethal brigade-sized unit the Army has ever fielded. The Army expects FCS-equipped brigade combat teams to provide significant warfighting capabilities to the Department of Defense's (DOD) overall joint military operations.

Since being approved for development in 2003, the program has gone through several restructures and modifications. In 2004, the program re-introduced four systems that had been deferred, lengthened the development and production schedules, and instituted plans to spin out

¹Pub. L. No. 109-163, §211.

²GAO, *Defense Acquisitions: Decisions Needed to Shape Army's Combat Systems for the Future*, [GAO-09-288](#) (Washington, D.C.: March 12, 2009).

selected FCS technologies and systems to current Army forces throughout the program's development phase. In 2006, the Army again deferred four systems, among other changes. In 2008, the Army altered its efforts to spin out capabilities to current forces from heavy brigade combat teams to infantry brigade combat teams.

The FCS program began in May 2003 before the Army defined what the systems were going to be required to do and how they would interact. The Army moved ahead without determining whether the concept could be successfully developed with existing resources—without proven technologies, a stable design, and available funding and time. The Army projects the FCS program will cost \$159 billion, not including all the costs to the Army, such as complementary programs. The Army is also using a unique partner-like arrangement with a lead system integrator (LSI), Boeing, to manage and produce the FCS. For these and other reasons, the FCS program is recognized as being high risk and requiring special oversight. Accordingly, in 2006, Congress mandated that DOD hold a milestone review following the FCS preliminary design review.³ Congress directed that the review include an assessment of whether (1) the needs are valid and can best be met with the FCS concept, (2) the FCS program can be developed within existing resources, and (3) the program should continue as currently structured, be restructured, or be terminated. Congress required the Secretary of Defense to assess the program against specific criteria, including the maturity of critical technologies, program risks, demonstrations of the FCS concept and software, and a cost estimate and affordability assessment, and to report on findings by the time of the milestone review.

This statement is based on work we conducted between March 2008 and March 2009 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

³John Warner National Defense Authorization Act for Fiscal Year 2007, Pub. L. No. 109-364, § 214 (2006).

Significant Knowledge Gaps in Key System Development Areas

Assessed against the criteria to be used for the milestone review, the FCS program has significant knowledge gaps. Specifically, the program has yet to show that critical technologies are mature, design issues have been resolved, requirements and resources are matched, performance has been demonstrated versus simulated, and costs are affordable. The Army will be challenged to convincingly demonstrate the knowledge necessary to warrant an unqualified commitment to FCS at the 2009 milestone review.

While best practices and DOD policy preference are for each of a program's critical technologies to achieve a technology readiness level (TRL) of 7 prior to entering development, the Army is struggling to achieve a TRL 6, the level required for the milestone review, after almost 6 years of development. Although the Army projects that TRL 6 will be achieved by the time of the review, the Army will be challenged to do so. Dates for several key demonstrations have slipped, and several ratings have yet to be validated by independent reviewers. Furthermore, the Army's experience with maturing FCS technologies does not inspire confidence that it will be able to execute the fast-paced integration plans involved with advancing technologies to TRL 7 before the production decision in 2013.

Design knowledge expected to be available at the time of the milestone review may not provide the necessary confidence that FCS design risks are at acceptable levels. The Army continues to set and refine requirements in order to establish system designs, particularly at the system level. Although the Army plans to have completed all system-level preliminary design reviews before the milestone review, the schedule to close out all the reviews may take more time than anticipated, key risk items will have to be addressed, and design trade-offs will be necessary. For example, the projected weight of the FCS manned ground vehicles has increased, which could have a number of effects on vehicle performance. In the coming months, the Army will have to address these and other design and requirements conflicts. It is important to note that DOD's updated acquisition policy calls for holding preliminary design review at or near the time of the decision to begin development, which in the case of FCS was in 2003.

The Army will be challenged to meet the congressional direction to demonstrate—versus simulate—that the FCS warfighting concept will work by the time of the milestone review. At this time, limited demonstrations of select capabilities, including manned ground vehicles and software, have been conducted, but no meaningful demonstration that the FCS concept as a whole will work has been attempted. A thorough demonstration of the

FCS network, the linchpin of the FCS concept, will not be attempted until 2012. There have been some demonstrations of early versions of the lightweight armor and an active protection system, but the feasibility of the FCS survivability concept remains uncertain.

The Army is expected to update its cost estimate, currently \$159 billion, for the milestone review.⁴ Last year, the Army indicated its notional plans to increase estimates by about \$19 billion, but has not said whether it would have to trade off capabilities to accommodate the higher costs. The Army has also indicated its willingness to reduce funding to current force systems in favor of FCS. While the updated program cost estimate will be a better representation of actual costs than previous estimates, the program still has many risks and unprecedented challenges to meet, and thus, the estimate will likely change again as more knowledge is acquired.

Army Plans to Proceed with Production Commitments before Solid Level of Knowledge Demonstrated to Decision-makers

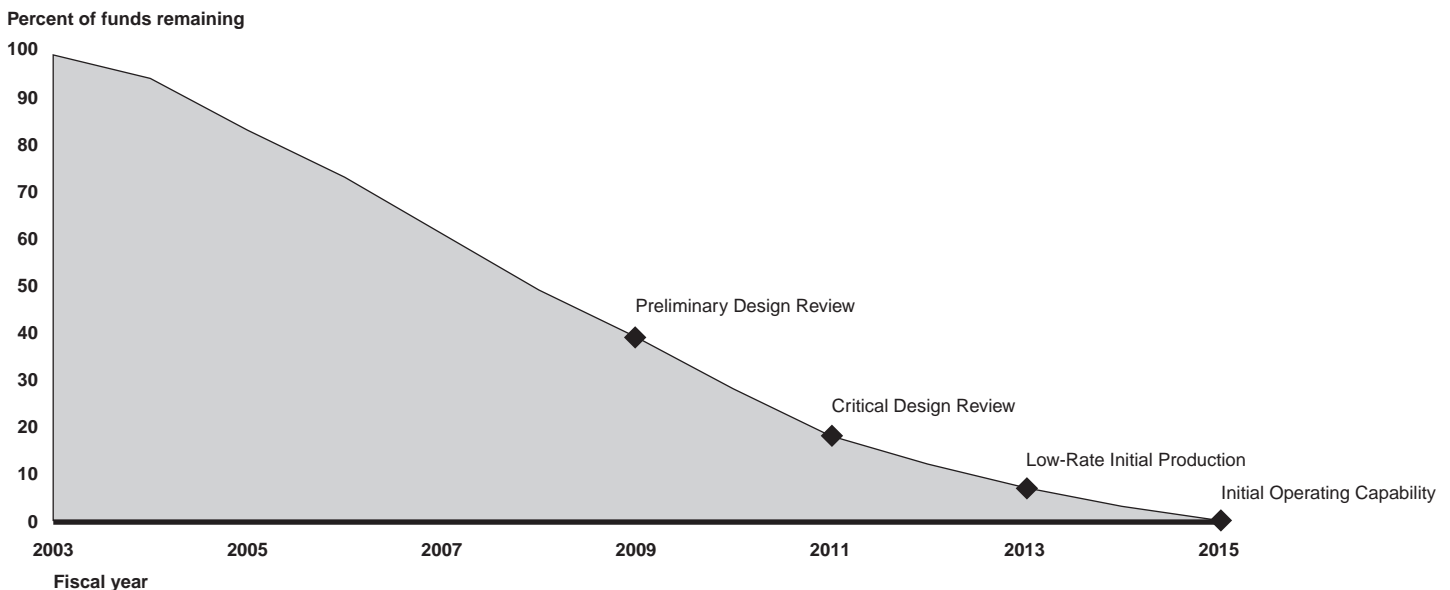
At the milestone review, DOD will have to evaluate at least three programmatic options to shape investments in combat systems for the Army, each of which presents challenges. The first involves the FCS program, which, as currently structured, has significant risks for execution. Second, the decision to produce spin out systems to current forces is expected to occur before full testing of production-representative prototypes. Third, the Army is considering altering the FCS strategy to follow an incremental approach, which is preferable to the current approach, but presents other challenges.

The FCS acquisition strategy is unlikely to be executable within current cost and schedule projections, given the significant amount of development and demonstration yet to be completed. The timing of upcoming commitments to production funding puts decision makers in the difficult position of making production commitments without knowing if FCS will work as intended. Under the current acquisition strategy, FCS decisions are not knowledge-based, nor do they facilitate oversight. For example, the Army has scheduled only 2 years between the critical design review and the production decision in 2013, leaving little time to gain knowledge between the two events. As a result, FCS will rely on immature prototypes for making the decision to proceed into production. Also, if the program receives approval to proceed at the milestone review this year,

⁴These costs do not include the costs of the FCS spin out initiative, currently estimated at about \$21 billion.

the Army will have only 40 percent of its financial and schedule resources left to complete what is typically the most challenging and expensive development work ahead, as depicted in figure 1 below.

Figure 1: Remaining FCS Research and Development Funding and Key Events



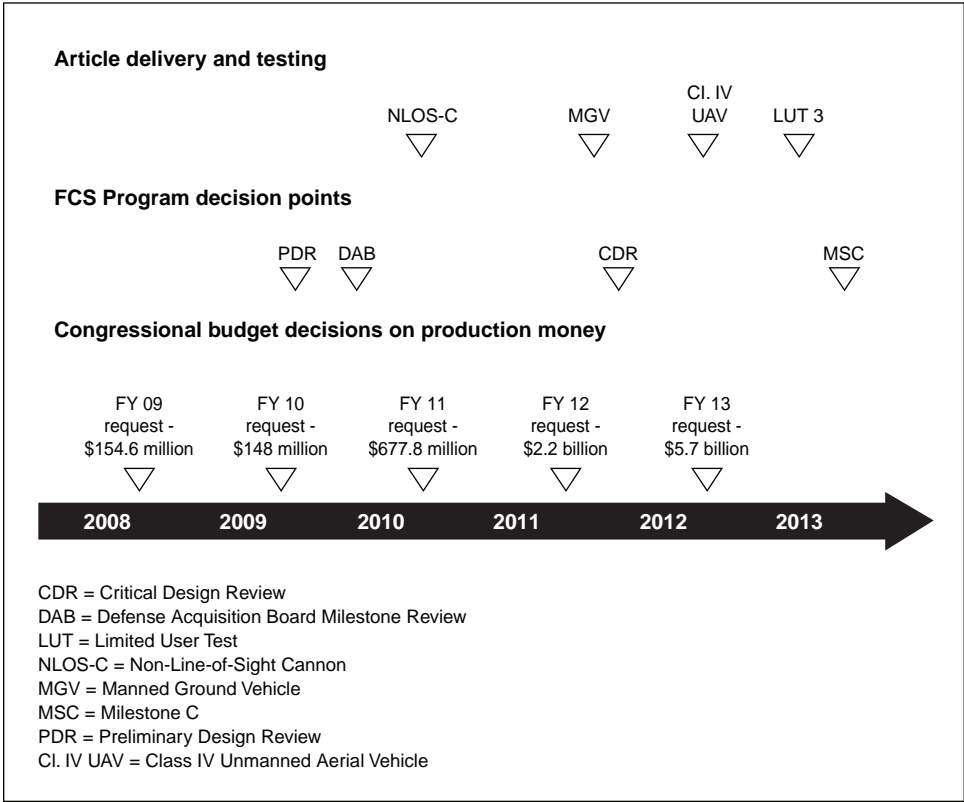
Source: U.S. Army (data); GAO (analysis and presentation).

Historical experience and recent independent cost estimates on FCS suggest that costs will grow beyond the Army's estimates. Our previous work has shown the development costs for programs with mature technologies increased by a modest average of 4.8 percent over the first full estimate, whereas the development costs for programs with immature technologies increased by a much higher average of 34.9 percent. Similarly, program acquisition unit costs for the programs with the most mature technologies increased by less than 1 percent, whereas the programs that started development with immature technologies experienced an average program acquisition unit cost increase of nearly 27 percent over the first full estimate. Our work also showed that most development cost growth occurred after the critical design review. Specifically, of the 28.3 percent cost growth that weapon systems average in development, 19.7 percent occurs after the critical design review.

Under the current strategy, the Army's plans for funding core production efforts put congressional decision makers in a difficult position in a number of ways. Facilitization costs begin in fiscal year 2011, the budget

for which will be presented to Congress in February 2010, several months after the milestone review and prior to the critical design review.⁵ In fact, there could still be action items from the preliminary design review to complete at that time. Further, when Congress is asked to approve funding for initial low-rate production of core FCS systems, the Army will not yet have proven that the FCS network and the program concept will work, a demonstration that is expected as part of Limited User Test 3 in 2012. This situation is illustrated further in figure 2 below.

Figure 2: FCS Program Events and Congressional Budget Decisions on Production Funds



Source: U.S. Army (data); GAO (analysis and presentation).

⁵The funds requested in fiscal year 2009 and 2010, and a portion of that in 2011 are for Non-Line-of-Sight-Cannon production.

Significant production funds will also be spent on the Non-Line-of-Sight Cannon and spin out systems between now and the FCS core production decision in 2013. To meet congressionally required fielding dates, the Army began building Non-Line-of-Sight Cannon prototypes last year, but has encountered some setbacks due to development issues and delays. The vehicles are planned to be used as training assets and will not be fieldable systems. The Army is planning for a seamless transition between these prototypes and production of the core FCS systems, but given the financial investment from the Army and consequently, the energized industrial base, this could create pressure to proceed into core production prior to achieving a solid level of knowledge on which to move forward.

Currently, the Army's efforts to field spin out systems relies on a rushed schedule that calls for making production decisions before production-representative prototypes have clearly demonstrated a useful military capability. A shift in focus on the Army's efforts to spin out capabilities to current forces from heavy brigade combat teams to infantry brigade combat teams resulted in moving the production decision from January 2009 to December 2009.⁶ However, only one key test has been conducted under the new structure, and this event was a shortened version of an event that was originally planned to focus on the heavy brigade combat team. Additionally, testing completed to date has involved surrogate or non-production representative forms of systems, and the three tests scheduled for this year will follow the same practice.

Army officials have said that they are considering an incremental or block acquisition approach to FCS in order to mitigate risks in four major areas: (1) immaturity of requirements for system survivability, network capability, and information assurance; (2) limited availability of performance trade space to maintain program cost and schedule given current program risks; (3) program not funded to Cost Analysis Improvement Group estimates and effect of congressional budget cuts; and (4) continuing challenges in aligning schedules and expectations for multiple concurrent acquisitions. Restructuring the FCS program around an incremental approach has the potential to alleviate the risks inherent in the current strategy and is an opportunity to apply recent DOD policy updates, such as the creation of configuration steering boards, and provide

⁶Heavy brigades are equipped with armor, such as the Bradley Fighting Vehicle. Light brigades are equipped with motorized infantry, such as the High Mobility Multi-purpose Wheeled Vehicle.

decision-makers with more information before program commitments are made. On the other hand, an incremental approach entails its own oversight challenges. First, it presents decision makers with another FCS strategy to consider, possibly after the fiscal year 2010 budget is submitted. Second, the approach must ensure that each increment stands on its own and is not dependent on future increments.

As DOD considers the current strategy, an incremental strategy, and its production commitments, it will also have to continue to pay close attention to the role being played by the FCS lead system integrator. We have previously reported that the role of the integrator posed oversight challenges. Since then, the Army has committed to using the integrator for initial production, potentially a larger role than initially envisioned.

Concluding Remarks

The 2009 milestone review is the most important decision on the Future Combat System since the program began in 2003. If the preliminary design reviews are successfully completed and critical technologies mature as planned in 2009, the FCS program will essentially be at a stage that statute and DOD policy would consider as being ready to start development. In this sense, the 2009 review will complete the evaluative process that began with the original 2003 milestone decision. Furthermore, when considering that the current estimate for FCS ranges from \$159 billion to \$200 billion when the potential increases to core program costs and estimated costs of spin outs are included, 90 percent or more of the investment in the program lies ahead. Even if a new, incremental approach to FCS is approved, a full milestone review that carries the responsibility of a go/no-go decision is still in order, along with attendant reports and analyses that are required inputs. In the meantime, a configuration steering board, as required by DOD policy, may help bridge the gaps between requirements and system designs and help in the timely completion of the FCS preliminary design reviews.

There is no question that the Army needs to ensure its forces are well equipped. The Army has vigorously pursued FCS as the solution, a concept and an approach that is unconventional, yet with many good features. The difficulties and redirections experienced by the program should be seen as revealing its immaturity, rather than as the basis for criticism. However, at this point, enough time and money have been expended that the program should be evaluated at the 2009 milestone review based on what it has shown, not on what it could show. The Army should not pursue FCS at any cost, nor should it settle for whatever the FCS program produces under fixed resources. Rather, the program direction taken after the milestone

review must strike a balance between near-term and long-term needs, realistic funding expectations, and a sound plan for execution. Regarding execution, the review represents an opportunity to ensure that the emerging investment program be put on the soundest possible footing by applying the best standards available, like those contained in DOD's 2008 acquisition policy, and requiring clear demonstrations of the FCS concept and network before any commitment to production of core FCS systems.

Any decision the Army makes to change the FCS program is likely to lag behind the congressional schedule for authorizing and appropriating fiscal year 2010 funds. Therefore, Congress needs to preserve its options for ensuring it has adequate knowledge on which to base funding decisions. Specifically, it does not seem reasonable to expect Congress to provide full fiscal year 2010 funding for the program before the milestone review is held nor production funding before system designs are stable and validated in testing.

In our report released March 12, 2009, we raised several matters for congressional consideration. We suggested Congress consider restricting budget authority for fiscal year 2010 until DOD fully complies with the milestone review requirements and provides a complete budget justification package for any program that emerges. In addition, Congress could consider not approving production or long lead item funds for core FCS until after the critical design review is satisfactorily completed and demonstrations have provided confidence that the FCS system-of-systems operating with the communications network will be able to meet its requirements.

We also made several recommendations to the Secretary of Defense including ensuring that the FCS program that emerges from the milestone review conform with current DOD acquisition policy and directing the Secretary of the Army to convene an FCS configuration steering board. We recommended that if an incremental approach is selected for FCS, the first increments should be justifiable on their own as worthwhile military capabilities that are not dependent on future capabilities for their value. We further recommended that spin out items are fully tested in production representative form before they are approved for initial production. Finally, we recommended that the Secretary reassess the role of the lead system integrator, particularly with respect to any future role in production efforts.

Mr. Chairman, this concludes my prepared statement. I would be happy to answer any questions you or members of the subcommittee may have.

Contacts and Staff Acknowledgements

For future questions about this statement, please contact me on (202) 512-4841 or francisp@gao.gov. Individuals making key contributions to this statement include William R. Graveline, Assistant Director; William C. Allbritton; Noah B. Bleicher; Tana M. Davis; Marcus C. Ferguson; Carrie W. Rogers; and Robert S. Swierczek.

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